COSPAS-SARSAT LEOLUT COMMISSIONING STANDARD

C/S T.005
Issue 2 - Revision 1
October 1999

COSPAS SARSAT

COSPAS-SARSAT LEOLUT COMMISSIONING STANDARD

History

Issue	Revision	Date	Revised Pages	Comments
1	0	December 1990	All	Approved (CSC-5)
2	0	October 1998	All	Approved (CSC-21)
2	1	October 1999	cover to Annex C, D-2, D-7, Annex E, H-2, Annex I	Approved (CSC-23)

LIST OF PAGES

TABLE OF CONTENTS

Page

LIST OF FIGURES

LIST OF ANNEXES

1. INTRODUCTION

1.1 Purpose

The Cospas-Sarsat LEOLUT Commissioning Standard shall be used to verify that a LEOSAR Local User Terminal (LEOLUT) complies with the Cospas-Sarsat LEOLUT Performance Specification (C/S T.002). The national Administrations that wish to connect a new LEOLUT to the Cospas-Sarsat network shall conduct the tests and provide the data, which is specified in this document, to the Cospas-Sarsat Secretariat. For multi-LEOLUT environments, each LEOLUT shall be commissioned individually as if it were a stand-alone LEOLUT.

1.2 Scope

This standard specifies LEOLUT commissioning for the 406 MHz SARP channel (Processed Data Stream, PDS), the 406 MHz SARR channel (Ground Search and Rescue Processor, G-SARP), the 121.5 MHz SARR channel, and for combined processing on the 406 MHz channels (i.e. SARP/SARR, SARP/GEOSAR, SARR/GEOSAR, and SARP/SARR/GEOSAR). Section 2 defines the general commissioning process, section 3 describes the evaluation of the operational requirements, section 4 specifies the commissioning of functional and processing requirements, and section 5 specifies the commissioning of performance requirements. The annexes define the test requirements, signal characteristics, test beacon messages, the format of the test data which is to be collected, and the format of the commissioning report which is to be submitted to the Cospas-Sarsat Secretariat.

1.3 Reference Documents

The following documents contain useful information applicable to LEOLUT commissioning:

a. Specifications for 121.5 MHz emergency beacons:
   (i) ITU Radio Regulations, Appendix 37A and Recommendation ITU-R M.690-1,
   (ii) ICAO Convention on International Civil Aviation, Annex 10, Volume 1, Part 1, Chapter 5;

b. C/S A.001, Cospas-Sarsat Data Distribution Plan (DDP);

c. C/S A.002, Cospas-Sarsat Mission Control Centres Standard Interface Description (SID);

d. C/S A.005, Cospas-Sarsat MCC Performance Specification and Design Guidelines;

e. C/S A.006, Cospas-Sarsat MCC Commissioning Standard;

f. C/S T.001, Specification for Cospas-Sarsat 406 MHz Distress Beacons;

g. C/S T.002, Cospas-Sarsat LEOLUT Performance Specification and Design Guidelines;

h. C/S T.003, Description of the Cospas-Sarsat LEOSAR Space Segment;

i. C/S T.006, Cospas-Sarsat Orbitography Network Specification;

j. C/S T.009, Cospas-Sarsat GEOLUT Performance Specification and Design Guidelines; and

k. C/S T.010, Cospas-Sarsat GEOLUT Commissioning Standard.

- END OF SECTION 1-

2. LEOLUT COMMISSIONING

2.1 General

The Cospas-Sarsat LEOLUT commissioning tests defined in this document are intended to be performed in addition to national acceptance tests, and are required prior to fully integrating a LEOLUT into the Cospas-Sarsat Ground Segment. Conducting these tests and assessing the results is the responsibility of the national Administration desiring to commission a LEOLUT.

The tests verify the LEOLUT's ability to receive and process signals transmitting in the 406 MHz SARP channel, and optionally the 406 MHz SARR and the 121.5 MHz SARR channels in accordance with document C/S T.002 (LEOLUT specification). A cross reference of the requirements in C/S T.002 and the corresponding commissioning requirements specified in this document is provided in the "Summary Table" of the commissioning report (Annex A). The tests shall be conducted with the LEOLUT in its operational configuration and location, and connected to the associated MCC. However, the data should not be distributed to other Cospas-Sarsat Ground Segment Operators.

The LEOLUT may be commissioned in various modes depending on the configuration of the LEOLUT, and the data channels processed. The 406 MHz SARP channel is specifically tested with the use of global-mode PDS data and local-mode PDS data. The 406 MHz SARR channel is specifically tested with the use of data obtained only from the G-SARP. If the LEOLUT is expected to operate with combined data from the 406 MHz SARP and SARR channels or with 406 MHz data from GEOLUTs, the combined modes of operation should be analyzed and reported separately in the commissioning report (Annex A), as specified in section 5.1.4.

For LEOLUTs which use data from GEOLUTs for combined LEO/GEO processing, it is a prerequisite that the GEOLUTs meet the specification requirements of document C/S T.009 and be commissioned in accordance with document C/S T.010, in addition to the specific LEO/GEO commissioning requirements detailed herein.

2.2 Pre-Test Requirements

Prior to commencing the test, the national Administration conducting the test shall coordinate with appropriate authorities in its SAR region, as well as notifying all affected Cospas-Sarsat MCCs, of the test periods of operation and the test beacon location(s), and is also invited to provide this information to the Cospas-Sarsat Secretariat.

2.3 Test Data Collection

The commissioning process for the 406 MHz SARP, 406 MHz SARR and 121.5 MHz SARR channels comprises the collection of specific beacon messages and the specified numbers of solutions. If a LEOLUT has the capability to process data from multiple channels or multiple

sources, the data acquisition for the commissioning tests may be conducted individually or in parallel.

Data should be collected from all available channels from all commissioned satellites.

2.4 Frequency Registration

National Administrations should register the 1544.5 MHz downlink frequency for their LEOLUT site(s) with the International Telecommunication Union (ITU) using the sample form provided at Annex I.

2.5 Data Collection Limitation

Only the data collected from those satellite channels that comply with documents C/S T.003 (LEOSAR space segment description) and C/S T.011 (GEOSAR payload description) shall be used for the statistical data analysis. Data from satellites in an Initial Operational Capability (IOC) status should not be used for test data collection.

2.6 Submission of Results

The results of the LEOLUT commissioning process, shall be documented in the commissioning report, in accordance with the format detailed at Annex A.

The complete commissioning report and the data files detailed at Annex E are to be submitted to the Cospas-Sarsat Secretariat for further evaluation as required.

2.7 LEOLUT Commissioning and Integration

The test results, as defined in the annexes shall be submitted to the Cospas-Sarsat Secretariat. The results will be reviewed by the Cospas-Sarsat Secretariat and submitted to the Joint Committee. The LEOLUT will be integrated into the Cospas-Sarsat Ground Segment as described in Annex G and Annex H.

2.8 LEOLUT/MCC Interface

Validation of the LEOLUT/MCC interface shall be completed by the national Administration as part of the LEOLUT commissioning.

2.9 Confirmation of Requirements

The national Administration shall confirm compliance to all requirements detailed in this document with either a measurement, verification, declaration, or combination of these methods. The exact method of confirming compliance for each respective requirement is identified in the summary table of the commissioning report (Annex A).

A measurement requires the national Administration to conduct a test and include the supporting data as part of the commissioning report. A verification requires a national Administration to test a requirement, however, supporting data does not need to be provided as part of the commissioning report. A declaration of compliance confirms that specific requirements are met although not necessarily tested as part of the commissioning process. Conformance to all requirements shall be documented in the commissioning report.

2.10 Change of Location

If the location of a commissioned LEOLUT has been changed, the responsible national Administration shall ensure that the LEOLUT continues to satisfy C/S T.002 requirements prior to resuming operations. Additionally, the national Administration shall:

a. confirm that the level of local interference does not adversely affect LEOLUT performance;

b. verify the performance of the communication links in the new location;

c. verify the performance of the antenna and RF subsystems; and

d. update the technical file of the LEOLUT commissioning report (Appendix 1 to Annex A refers) by providing a declaration that the LEOLUT satisfies C/S T.002 requirements and the following information, to the Cospas-Sarsat Secretariat:

   (i) Antenna Characteristics (Annex A, Appendix 1, section A.2.1),

   (ii) General LUT Indoor Equipment Description (Annex A, Appendix 1, section A.2.2) - identify any changes to the equipment configuration, or indicate “no change” if the configuration has not been changed,

   (iii) General Capabilities (Annex A, Appendix 1, section A.2.3), - identify any changes to the general capabilities of the LEOLUT, or indicate “no change” if appropriate,

   (iv) Communications Capability (Annex A, Appendix 1, section A.4),

   (v) Coverage (Annex A, Appendix 1, section A.5),

   (vi) Location (Annex A, Appendix 1, section A.6).

- END OF SECTION 2 -

page left blank

3. EVALUATION OF OPERATIONAL REQUIREMENTS

3.1 LEOLUT Data Availability

The LEOLUT data availability shall be measured during the commissioning period in accordance with guidance provided at Annex B. If any basic function or requirement is not performed by the LEOLUT, the LEOLUT data shall be considered unavailable.

3.2 Data Requirements

The national Administration shall ensure that the LEOLUT provides the data necessary for the associated MCC to distribute alert data according to the document C/S A.002 (SID). This shall be verified and noted in the appropriate section of the LEOLUT commissioning report.

3.3 Data Channels

The data channels processed by the LEOLUT shall be listed in the commissioning report. The national Administration shall verify that the appropriate data channel requirements, as detailed at document C/S T.002 (LEOLUT specification), are satisfied, and note this in the appropriate section of the LEOLUT commissioning report. Furthermore, if the LEOLUT implements combined LEO/GEO processing, the identification of the sources of the GEOSAR data used shall be declared in the appropriate section of the commissioning report.

3.4 Satellite Tracking Capability

The LEOLUT's ability to track and recover data shall be measured for all scheduled passes during the commissioning period, according to the guidance provide at Annex B. The test results and associated analysis shall be included in the appropriate sections of the commissioning report.

3.5 Satellite Visibility/Signal Lock

The national Administration shall conduct the tests and record the measurements detailed at Annex B, to demonstrate conformance with the satellite visibility specification contained at document C/S T.002 (LEOLUT specification). The test results and associated analysis shall be included in the appropriate sections of the commissioning report.

3.6 Status and Alarm

The national Administration shall describe the status and alarm functions of the LEOLUT and declare compliance in the appropriate section of the LEOLUT commissioning report.

3.7 RF Radiation and Emissions

The national Administration shall ensure that the LEOLUT does not radiate or emit any radio frequency signals that will interfere with the functioning of the Cospas-Sarsat System. This shall be declared in the appropriate section of the LEOLUT commissioning report.

- END OF SECTION 3 -

4. EVALUATION OF FUNCTIONAL AND PROCESSING REQUIREMENTS

4.1 Functional Requirements

4.1.1 Antenna and RF Subsystem

The national Administration shall verify that the antenna and RF subsystem of the LEOLUT can acquire, track and receive the downlink signals from Cospas-Sarsat satellites. This verification shall be documented in the LEOLUT commissioning report.

4.1.2 Time and Frequency Reference Subsystem

The national Administration shall declare in the LEOLUT commissioning report, the LEOLUT's capability to maintain time and frequency subsystems according to document C/S T.002 (LEOLUT specification).

4.1.3 Orbit Maintenance Subsystem

The national Administration shall declare, in the LEOLUT commissioning report, the LEOLUT's capability to maintain accurate satellite orbital elements and tracking schedules as described in document C/S T.002 (LEOLUT specification).

4.1.4 MCC Interface

The national Administration shall verify that the LEOLUT provides timely alert data of the level of quality and detail specified in documents C/S A.002 (SID) and C/S A.005 (MCC specification). This verification shall be documented in the LEOLUT commissioning report.

4.2 406 MHz Beacon Message Processing

The national Administration shall conduct tests, and record the results in the appropriate section of the commissioning report, which confirm the LEOLUTs compliance to the "channels processing specifications" detailed in document C/S T.002 (LEOLUT specification).

These tests require the LEOLUT to process the 406 MHz data described at Annex D in the manner prescribed. The processing consists of bit verification, message validation, message processing and transmission. The specific beacon test messages contained at Annex D can be transmitted by a test beacon or a beacon simulator.

National Administrations should ensure that test beacons or simulators are capable of transmitting the beacon messages at the frequencies described at Annex D. Alternatively, national Administrations may arrange for the simulators in the United States or France to uplink the messages contained at Annex D. If the test messages cannot be transmitted during

the commissioning period, the national Administration may develop alternative methods of confirming compliance with the beacon message processing requirements and proceed with the commissioning test, and preparation and submission of the commissioning report. The unavailability of the test beacon or simulators to uplink the test messages contained at Annex D shall not prevent the LEOLUT from being commissioned, if other adequate methods are used. If alternative methods are used, these methods shall be completely documented in the commissioning report.

- END OF SECTION 4 -

5. EVALUATION OF PERFORMANCE REQUIREMENTS

The national Administration shall conduct the tests defined at Annex C to confirm conformance with the LEOLUT performance requirements detailed at document C/S T.002 (LEOLUT specification). The results of these tests shall be included in the LEOLUT commissioning report. Additional guidance pertaining to the tests detailed at Annex C is provided in the remainder of this section.

5.1 406 MHz Test Conditions

5.1.1 406 MHz SARP Test

SARP data shall be collected from the available Cospas-Sarsat orbitography/test beacons (see Annex II/E of document C/S A.001 (DDP)). At least one test/orbitography beacon shall be outside the local-mode coverage area.

5.1.1.1 Satellite Passes

The performance measurement test shall consist of receiving and processing all scheduled passes during the test period. Global-mode data shall be obtained at least once from each available Cospas and Sarsat satellite.

A pass schedule for all satellite passes during the test period, as defined in Annex E, shall be submitted to the Cospas-Sarsat Secretariat.

5.1.1.2 Orbitography or Reference Beacons

A list of those orbitography or reference beacons that are used by the LEOLUT during the SARP test for updating the orbital elements shall be provided in the commissioning report. Solution data from these beacons shall not be used in the calculation of the LEOLUT performance statistics for those passes in which they are used for updating the orbits.

5.1.2 406 MHz SARR Test

A test shall be conducted to confirm that the LEOLUT 406 MHz local-mode SARR processing satisfies the performance requirements detailed in document C/S T.002. This test will be conducted using only data received via the SARR channel.

5.1.2.1 Test Beacons

Local-mode tests shall be conducted with type-approved Cospas-Sarsat 406 MHz beacons coded with the test protocol and/or approved beacon simulators (i.e. not an orbitography beacon). The beacons must be placed within the LEOLUT local-mode

coverage area at a position known to within 100 metres and shall remain fixed at this position throughout the test. The beacon locations shall be given with respect to the reference system given in section 5.2.1. The test beacons shall not be used for updating the orbital elements.

5.1.2.2 Satellite Passes

Local-mode tests shall consist of receiving and processing all scheduled passes from all commissioned satellites during the test period.

5.1.3 Combined SARP/SARR Test

If the LEOLUT is expected to operate with combined data from the 406 MHz SARP and SARR channels, then a test shall be conducted to confirm that the LEOLUT satisfies the performance requirements detailed in document C/S T.002. This test will be conducted using data received from the SARP (local and global) and the G-SARP, and shall include data received from both within and external to the LEOLUT's local-mode coverage area.

5.1.4 Combined LEO/GEO Processing

If the LEOLUT is expected to perform combined LEO/GEO processing, then tests shall be conducted to confirm that the LEOLUT satisfies the LEO/GEO performance requirements detailed in document C/S T.002. The following channel combinations shall be tested if they are used operationally:

a. combined SARP/GEOSAR or SARP/SARR/GEOSAR; and
b. combined SARR/GEOSAR.

5.1.5 Solution Statistics

All solutions from test/orbitography beacons used for commissioning shall be collected. Statistics shall be calculated on two types of solutions.

a. Solutions meeting the following criteria:

   (i) having four (4) or more data points,
   (ii) data points bracketing the TCA of the satellite to the beacon, and
   (iii) having an absolute value of cross-track angle (|CTA|) between 1 degree and 20 degrees,

   shall be classified as nominal solutions.

b. Solutions not meeting the criteria above shall be classified as marginal solutions.

The statistics which shall be derived are listed in Annex C.

5.1.6 Minimum Point Solution Statistics

LEOLUTs which implement combined LEO/GEO processing shall provide minimum point location accuracy solution statistics for all LEO/GEO channel combinations listed in 5.1.4 in addition to the requirements detailed in section 5.1.5.

Minimum point solutions are defined as those solutions which are calculated from only two LEOSAR data points plus data from the GEOSAR system. Since minimum point solutions are a subset of marginal solutions, they are incorporated into the marginal solutions statistics. Additionally, the minimum point solution location accuracy statistics shall be reported separately.

5.1.7 Solution Data

The solution data from all tracked satellite passes shall be provided for each orbitography, beacon simulator, and/or test beacon used during the test period. A minimum of:

a. 1000 nominal solutions shall be used for the SARP test (SARP data only);
b. 100 nominal solutions for the combined SARP/SARR test (all solutions shall include SARP and SARR data);
c. 50 nominal solutions shall be used for the local-mode SARR test (SARR data only);
d. 100 nominal solutions and 100 minimum point solutions for the combined SARP/GEOSAR or SARP/SARR/GEOSAR tests; and
e. 100 nominal solutions and 100 minimum point solutions for the combined SARR/GEOSAR test.

All solutions shall be recorded in ASCII format onto a diskette and provided to the Secretariat as part of the commissioning report.

The required data elements to be included in the commissioning report ASCII files, are listed in Annex E.

5.2 121.5 MHz Test Conditions

5.2.1 Test Signal

Due to the wide variation in characteristics of commercially available 121.5 MHz beacons, the standard 121.5 MHz test signal specified in Annex F is to be used to assure the uniformity of test results. The test results using this signal will not necessarily be indicative of the performance achieved with other types of 121.5 MHz beacons. A declaration shall be made in the commissioning report that the 121.5 MHz test signals used in the LEOLUT commissioning satisfies the requirements specified at Annex F.

This test transmitter shall be placed within the LEOLUT local-mode coverage area and the location of its antenna shall be determined to within 100 metres. This location shall be given with respect to the Bureau International de l'Heure (BIH) geodetic reference system with a reference ellipsoid semi-major axis of 6378137 metres and a flattening (ellipticity) of 1/298.2572. The test transmitter shall remain at the selected position throughout the test.

The national Administration is also requested to conduct some tests using samples of 121.5 MHz beacons that are in common use within the LEOLUT coverage area. The statistics shall be provided in the format defined in the commissioning report, and the data files shall be provided in accordance with Annex E.

5.2.2 Satellite Passes

The performance evaluation test consist of receiving and processing all scheduled passes during the test period. A minimum of 10 passes having test signal solutions from each Cospas and Sarsat satellite are required.

A pass schedule for all satellite passes during the test period, as defined in Annex E, shall be submitted to the Cospas-Sarsat Secretariat.

5.2.3 Solution Statistics

Statistics shall be calculated on two types of solutions.

a. Solutions meeting the following criteria shall be classified as nominal solutions:

   (i) having four (4) or more minutes of beacon data,
   (ii) beacon data bracketing the TCA of the satellite to the beacon, and
   (iii) having an absolute value of cross-track angle (|CTA|) between 1 degree and 20 degrees.

b. Solutions not meeting the criteria above shall be classified as marginal solutions.

The statistics shall be provided in the format defined in the commissioning report, and the data files shall be provided in accordance with Annex E.

5.2.4 Solution Data

All solution data relevant to the test signal shall be provided for each pass during the test period, in the format defined in Annex E.

-END OF SECTION 5-

ANNEXES TO
COSPAS-SARSAT
LEOLUT COMMISSIONING STANDARD

ANNEX A

LEOLUT Commissioning Report

Country or national Administration: _____

Location of LEOLUT: _____

Cospas-Sarsat Identifier: _____

Operational Configuration _____ (see Note)

Start of Commissioning Period: _____

End of Commissioning Period: _____

Section 1.0 contains a summary of the commissioning results as well as the declarations (D) and verifications (V), by the national Administration, for requirements not specifically measured.

The organization of the summary table follows the requirements contained in document C/S T.002. Section 2.0 contains the measurements (M) to support the results presented in section 1.0, a copy of the associated data is provided in ASCII format as required by document C/S T.005. A technical description of the LEOLUT is presented in Appendix 1.

Note: When combined LEO/GEO processing is implemented, the sources (i.e. satellite and GEOLUT) of any GEOSAR data used by LEOLUT shall be identified.

1.0 Summary Table

Paragraph in C/S T.002	Requirement or Test	Pass Criteria	Result	Pass/ Fail	Method of Compliance	Declaration/ Verification or Comments
3.1	LEOLUT Data Availability	A ≥ 95			M	
3.2	Data Requirements	n/a	n/a		V	
3.3	Data Channels	Minimum 406 MHz Channel	n/a		V	
3.4	Satellite Tracking Capability	ST > 99			M	
3.5	Satellite Visibility/Signal Lock	L = 0			M	
3.6	Status and Alarm	n/a	n/a		D	Include description in technical file
3.7	RF Radiation/Emissions	n/a	n/a		D	

Paragraph in C/S T.002	Requirement or Test	Pass Criteria	Result	Pass/ Fail	Method of Compliance	Declaration/ Verification or Comments
4.1.1	Antenna and RF Subsystem	n/a	n/a		V	
4.1.2	Time and Frequency Reference Subsystem	n/a	n/a		V	
4.1.3	Orbit Maintenance Subsystem	Maintenance for up to 8 Satellites. Update using 2 Methods.	n/a		D	
4.1.4	MCC Interface	n/a	n/a		V	
4.2.2.1	406 MHz SARP Channel Data Recovery	n/a	n/a		V	Ability to recover global and local-mode PDS data
4.2.2.2	406 MHz SARR Channel Data Recovery	Exact Match on 9 Bit Frame Synch	n/a		D	Achieve identical match on 9 bit frame synchronization
4.2.3	Bit Verification Test - BV1	See Annex D to C/S T.005	n/a		M	
	Bit Verification Test - BV2	See Annex D to C/S T.005	n/a		M	
4.2.4	Beacon Message Validation Test - MV1	See Annex D to C/S T.005	n/a		M	
	Beacon Message Validation Test - MV2	See Annex D to C/S T.005	n/a		M	
	Beacon Message Validation Test - MV3	See Annex D to C/S T.005	n/a		M	
	Beacon Message Validation Test - MV4	See Annex D to C/S T.005	n/a		M	
4.2.5	Beacon Message Processing Test - LP1	See Annex D to C/S T.005	n/a		M	
	Beacon Message Processing Test - LP2	See Annex D to C/S T.005	n/a		M	
	Beacon Message Processing Test - LP3	See Annex D to C/S T.005	n/a		M	
	Beacon Message Processing Test - LP4	See Annex D to C/S T.005	n/a		M	
	Beacon Message Processing Test - IV1	See Annex D to C/S T.005	n/a		M	
4.2.6	Time and Frequency Requirements	n/a	n/a		D	
4.2.7	Doppler Processing and Validation Test - DP1	n/a	n/a		M	

Paragraph in C/S T.002	Requirement or Test	Pass Criteria	Result	Pass/ Fail	Method of Compliance	Declaration/ Verification or Comments
4.2.7.1	Selection of Data Points	--	--	--	--	Requirement the same as requirement 4.2.4 in C/S T.002
4.2.7.2	Rejection of Data Points Test - DP2	See Annex D to C/S T.005	n/a		M	
4.2.7.3	Combining Global/Local-mode SARP Data	n/a	n/a		D	
4.2.7.4	Combining SARR/SARP Data	n/a	n/a		D	
4.2.7.5	Combining LEO/GEO Data	n/a	n/a		V	Alert msg to MCC shall include sources of GEO data & indicate beacon freq. Stability/instability.
4.2.7.6	Validation of Doppler Locations	n/a	n/a		D	
4.2.7.7	Beacon Message Assignment	--	--	--	--	Requirement the same as requirement 4.2.5 in C/S T.002
4.2.8	Transmission of Alert Data	--	--	--	--	Requirement the same as requirement 3.2 in C/S T.002
4.3.1	121.5 MHz Signal Detection and Doppler Location	n/a	n/a		D	
4.3.2	121.5 MHz Doppler Processing	n/a	n/a		D	
5.1.1	RF Signal Margin	n/a	n/a		D	
5.1.2	Processing Time	PT < 15 min for 99% of passes			M	Requirement applicable to all processing combinations
5.1.3	Orbit Determination	Error ≤ 2 km	n/a		D	
5.1.4	Ambiguity Resolution	A + B = 100			V	
5.1.5	406 MHz SARP Error Ellipse Nominal Solutions	M/N > 0.40 and M/N < 0.60			M	
	406 MHz SARP Error Ellipse Marginal Solutions	M/N > 0.40 and M/N < 0.60			M	
	406 MHz SARR Error Ellipse Nominal Solutions	M/N > 0.40 and M/N < 0.60			M	
	406 MHz SARR Error Ellipse Marginal Solutions	M/N > 0.40 and M/N < 0.60			M	
	121 MHz SARR Error Ellipse	M/N > 0.40 and M/N < 0.60			M	

Paragraph in C/S T.002	Requirement or Test	Pass Criteria	Result	Pass/ Fail	Method of Compliance	Declaration/ Verification or Comments
5.2.1	406 MHz SARP Data Recovery	DR ≥1.0			M	
5.2.2	406 MHz SARP Time and Frequency Calculation	1 millihertz and 1 millisecond resolution			D	
5.2.3	406 MHz SARP Beacon Capacity	90 beacons in local-mode 200 beacons in global-mode			D	
5.2.4	406 MHz SARP Location Accuracy Nominal Solutions	M/N ≥ 0.95 (5 km)			M	
		M/N ≥ 0.98 (10 km)			M	
	406 MHz SARP Location Accuracy Marginal Solutions	M/N ≥ 0.60 (5 km)			M	
		M/N ≥ 0.80 (20 km)			M	
5.2.5	406 MHz SARP Ambiguity Resolution Nominal Solutions	M/N ≥ 0.90			M	
	406 MHz SARP Ambiguity Resolution Marginal Solutions	M/N ≥ 0.60			M	
5.3.1	406 MHz SARR Signal Sensitivity	Signal Sensitivity better than 36dB-Hz			D	
5.3.2	406 MHz SARR Beacon Message Throughput	T ≥ 0.75			M	
5.3.3	406 MHz SARR Probability of Doppler Location	PDL ≥ 0.95			M	
5.3.4	406 MHz SARR Time and Frequency Calculation	350 millihertz and 10 ms			D	
5.3.5	406 MHz SARR Beacon Capacity	10 beacons			D	
5.3.6	406 MHz SARR Location Accuracy Nominal Solutions	M/N ≥ 0.95 (5 km)			M	
		M/N ≥ 0.98 (10 km)			M	
	406 MHz SARR Location Accuracy Marginal Solutions	M/N ≥ 0.60 (5 km)			M	
		M/N ≥ 0.80 (20 km)			M	

Paragraph in C/S T.002	Requirement or Test	Pass Criteria	Result	Pass/ Fail	Method of Compliance	Declaration/ Verification or Comments
5.3.7	406 MHz SARR Ambiguity Resolution Nominal Solutions	M/N ≥ 0.90			M	
	406 MHz SARR Ambiguity Resolution Marginal Solutions	M/N ≥ 0.60			M	
5.3.8	406 MHz False Alert Prevention	False Alerts Caused by Processing Anomalies $< 1 \times 10^{-4}$			D,V	
5.3.9	406 MHz Processing Bandwidth	406.010 to 406.090 MHz			D	
5.4	Combined SARP and SARR Processing	as per document C/S T.002			D	Only applicable to LEOLUTs which combine SARP and SARR data
5.4.a	Combined SARP and SARR location accuracy nominal solutions	M/N ≥ 0.95 (5 km)			M	Only applicable to LEOLUTs which combine SARP and SARR data
		M/N ≥ 0.98 (10 km)			M	
	Combined SARP and SARR location accuracy marginal solutions	M/N ≥ 0.60 (5 km)			M	
		M/N ≥ 0.80 (20 km)			M	
5.4.b	Combined SARP and SARR ambiguity resolution nominal solutions	M/N ≥ 0.90			M	Only applicable to LEOLUTs which combine SARP and SARR data
	Combined SARP and SARR ambiguity resolution marginal solutions	M/N ≥ 0.60			M	
5.4.c	Combined SARP and SARR error ellipse nominal solutions	M/N > 0.40 and M/N < 0.60			M	Only applicable to LEOLUTs which combine SARP and SARR data
	Combined SARP and SARR error ellipse marginal solutions	M/N > 0.40 and M/N < 0.60			M	
5.5	Combined SARP/GEOSAR or SARP/SARR/GEOSAR Processing	as per document C/S T.002			D	Only applicable to LEOLUTs which combine LEOSAR and GEOSAR data

Paragraph in C/S T.002	Requirement or Test	Pass Criteria	Result	Pass/ Fail	Method of Compliance	Declaration/ Verification or Comments
5.5.1.a	Combined SARP/GEOSAR or SARP/SARR/GEOSAR Processing location accuracy nominal solutions	M/N ≥ 0.95 (5 km)			M	Only applicable to LEOLUTs which combine LEOSAR and GEOSAR data
		M/N ≥ 0.98 (10 km)			M	
	Combined SARP/GEOSAR or SARP/SARR/GEOSAR Processing location accuracy marginal solutions	M/N ≥ 0.60 (5 km)			M	
		M/N ≥ 0.80 (20 km)			M	
5.5.2	Combined SARP/GEOSAR or SARP/SARR/GEOSAR Processing location accuracy minimum point solutions	M/N ≥ 0.60 (5 km)			M	Only applicable to LEOLUTs which combine LEOSAR and GEOSAR data
		M/N ≥ 0.80 (20 km)			M	
5.5.1.b	Combined SARP/GEOSAR or SARP/SARR/GEOSAR Processing ambiguity resolution nominal solutions	M/N ≥ 0.90			M	Only applicable to LEOLUTs which combine LEOSAR and GEOSAR data
	Combined SARP/GEOSAR or SARP/SARR/GEOSAR Processing ambiguity resolution marginal solutions	M/N ≥ 0.60			M	
5.5.1.c	Combined SARP/GEOSAR or SARP/SARR/GEOSAR Processing error ellipse nominal solutions	M/N > 0.40 and M/N < 0.60			M	Only applicable to LEOLUTs which combine LEOSAR and GEOSAR data
	Combined SARP/GEOSAR or SARP/SARR/GEOSAR Processing error ellipse marginal solutions	M/N > 0.40 and M/N < 0.60			M	
5.5	Combined SARR/GEOSAR Processing	as per document C/S T.002			D	Only applicable to LEOLUTs which combine SARP and GEOSAR data
5.5.1.a	Combined SARR/GEOSAR location accuracy nominal solutions	M/N ≥ 0.95 (5 km)			M	Only applicable to LEOLUTs which combine SARR and GEOSAR data
		M/N ≥ 0.98 (10 km)			M	

Paragraph in C/S T.002	Requirement or Test	Pass Criteria	Result	Pass/ Fail	Method of Compliance	Declaration/ Verification or Comments
	Combined SARR/GEOSAR location accuracy marginal solutions	M/N ≥ 0.60 (5 km)			M	Only applicable to LEOLUTs which combine LEOSAR and GEOSAR data
		M/N ≥ 0.80 (20 km)			M	
5.5.2	Combined SARR/GEOSAR location accuracy minimum point solutions	M/N ≥ 0.60 (5 km)			M	Only applicable to LEOLUTs which combine LEOSAR and GEOSAR data
		M/N ≥ 0.80 (20 km)			M	
5.5.1.b	Combined SARR/GEOSAR ambiguity resolution nominal solutions	M/N ≥ 0.90			M	Only applicable to LEOLUTs which combine SARR and GEOSAR data
	Combined SARR/GEOSAR ambiguity resolution marginal solutions	M/N ≥ 0.60			M	
5.5.1.c	Combined SARR/GEOSAR error ellipse nominal solutions	M/N > 0.40 and M/N < 0.60			M	Only applicable to LEOLUTs which combine SARR and GEOSAR data
	Combined SARR/GEOSAR error ellipse marginal solutions	M/N > 0.40 and M/N < 0.60			M	
5.6.1	121.5 MHz SARR Signal Sensitivity	Locate Signals with C/N_o 23 dB-Hz			D	
5.6.2	121.5 MHz SARR Beacon Capacity	10 beacons	n/a		D	
5.6.3	121.5 MHz SARR Location Accuracy Nominal Solutions	M/N ≥ 0.70 (20 km)			M	
		M/N ≥ 0.95 (40 km)			M	
5.6.4	121.5 MHz SARR Ambiguity Resolution	M/N ≥ 0.70			M	

2.0 Results of Measurements

This section contains the detailed results of measurements summarized in section 1.0. Each of the requirements is referred to in the report by the report reference number. The test procedure colum identifies the reference in document C/S T.005, where the detailed test procedure and pass / fail criteria is provided.

Report Ref #	Title	Test Procedure
2.1	**Operational Requirements**	
2.1.1	LEOLUT Data Availability (A)	B.1
2.1.2	Satellite Tracking (ST)	B.2
2.1.3	Satellite Visibility/Signal Lock (L)	B.3
2.2	**Functional and Processing Requirements**	
2.2.1	Bit Verification (test code sequence BV1 - BV2)	D1
2.2.2	Beacon Message Validation (test code sequence MV1 - MV4)	D1
2.2.3	Beacon Message Processing (test code sequence LP1 - LP4 and IV1)	D1
2.2.4	Doppler Processing and Validation (test code sequence DP1)	D1
2.2.5	Rejection of Data Points (test code sequence DP2)	D1
2.3	**Performance Requirements**	
2.3.1	Processing Time (PT)	C.1.2
2.3.2	**406 MHz SARP Statistics**	
2.3.2.1	406 MHz SARP Data Recovery (DR)	C.2.1
2.3.2.2	406 MHz SARP Location Accuracy	C.2.2
2.3.2.3	406 MHz SARP Ambiguity Resolution	C.2.3
2.3.2.4	406 MHz SARP Error Ellipse	C.2.4
2.3.3	**406 MHz SARR Statistics**	
2.3.3.1	406 MHz SARR Beacon Message Throughput (T)	C.2.5
2.3.3.2	406 MHz SARR Probability of Doppler Location (PDL)	C.2.6
2.3.3.3	406 MHz SARR Location Accuracy	C.2.2
2.3.3.4	406 MHz SARR Ambiguity Resolution	C.2.3
2.3.3.5	406 MHz SARR Error Ellipse	C.2.4

2.3.4	**Combined SARP / SARR Statistics**	
2.3.4.1	406 MHz Location Accuracy	C.2.2
2.3.4.2	406 MHz Ambiguity Resolution	C.2.3
2.3.4.3	406 MHz Error Ellipse	C.2.4
2.3.5	**Combined SARP/GEOSAR or SARP/SARR/GEOSAR Statistics**	
2.3.5.1	406 MHz Location Accuracy	C.2.2
2.3.5.2	406 MHz Ambiguity Resolution	C.2.3
2.3.5.3	406 MHz Error Ellipse	C.2.4
2.3.6	**Combined SARR/GEOSAR Statistics**	
2.3.6.1	406 MHz Location Accuracy	C.2.2
2.3.6.2	406 MHz Ambiguity Resolution	C.2.3
2.3.6.3	406 MHz Error Ellipse	C.2.4
2.3.7	**121.5 MHz Statistics**	
2.3.7.1	121.5 MHz SARR Location Accuracy	C.3.1
2.3.7.2	121.5 MHz SARR Ambiguity Resolution	C.3.2
2.3.7.3	121.5 MHz SARR Error Ellipse	C.3.3

3.0 Other Information

3.1 Confirmation that 121.5 MHz test beacon satisfies requirements stated in document C/S T.005.

3.2 The list of orbitography beacons used for orbit updates.

Appendix 1

Technical File

A.1 GENERAL

This appendix defines LUT information to be provided by national Administrations for LUT commissioning. The following information is required as a minimum:

A.2 LUT HARDWARE DESCRIPTION

A.2.1 Antenna Characteristics

a. type and number of antennas
b. gain/temperature ratio (G/T) at 5^o elevation angle above the local horizon, and actual elevation angle at which the G/T was measured
c. operational limitations
d. dedicated or shared

A.2.2 General LUT Indoor Equipment Description

a. equipment complement
b. stand alone, shared, or collocated with MCC
c. LUT manufacturer and model number
d. status and alarm functions

A.2.3 General Capabilities

a. processing capability (121.5 MHz, 243 MHz, 406 MHz SARP and SARR)
b. interference-monitoring capability
c. combined LEO/GEO processing capabilities

A.3 PROCESSING

a. specific-performance capability
b. manufacturer specifications
c. bit error rate on PDS channel at E_b/N_o of 13 dB
d. list of orbitography beacons used for orbit updating during the global-mode test
e. G-SARP parameters (processing bandwidth, signal sensitivity and beacon processing capacity)

A.4 COMMUNICATIONS CAPABILITY

a. primary-mode configuration
b. backup-mode configuration

A.5 COVERAGE

a. site-horizon profile
b. operational-tracking (elevation) limits

A.6 LOCATION [1]

a. latitude and longitude (of antenna)
b. altitude

-END OF ANNEX A-

[1] The location shall be given with respect to the Bureau International de L'Heure (BIH) geodetic reference system.

page left blank

ANNEX B

Statistics for Operational Requirements

B.1 LEOLUT Data Availability (A)

LEOLUT data availability measures the probability of receiving complete and accurate LEOLUT data at the MCC. Whenever a LEOLUT does not perform any of its functions, downtime (DT) is measured from LOS of the last successful satellite pass to AOS of the next successful satellite pass. Availability (A) is expressed as a percentage and is calculated by dividing the amount of operational time (OT) by the time required to be in operation (OTR). The time required to be in operation (OTR), expressed in hours, is 24 times the number of days in the commissioning period inclusive of all maintenance downtime. Downtime is that period of time when the LEOLUT fails to perform any of its basic functions. Therefore:

$A = (OT / OTR) * 100 = (1 - (DT / OTR)) * 100$ and shall be greater than 95.

B.2 Satellite Tracking (ST)

$ST = N/M * 100$ and shall be greater than 99, where M = number of non-conflicting passes visible to the LEOLUT with a maximum elevation angle of 5^o above the horizon during the commissioning period, and N = number of successfully tracked passes.

B.3 Satellite Visibility/Signal Lock (L)

L = number of passes that the LEOLUT lost carrier lock on the satellite downlink carrier signal while the satellite was above a 5^o elevation angle (except where local obstructions prevent this). L shall be equal to 0.

-END OF ANNEX B-

page left blank

ANNEX C

Statistics for Performance Requirements

C.1 Commissioning Status

C.1.1 General

This annex describes the statistics to be provided to the Cospas-Sarsat Secretariat when commissioning a LEOLUT. Data sets pertaining to number of points, TCA and CTA for nominal solutions and marginal solutions are defined in sections 5.1.4 (for 406 MHz solutions) and 5.2.3 (for 121.5 MHz solutions).

For 406 MHz statistics, the report must include a list of:

a) all 406 MHz beacons which were used for orbit updating during the test period; and
b) all 406 MHz beacons used for the statistical data analysis.

For 121.5 MHz statistics, the commissioning report must state explicitly that the 121.5 MHz test signal used met the requirements of Annex F.

C.1.2 Processing Time (PT)

Processing time is defined as the elapsed time between the Loss Of Signal (LOS) and the time at which all processed solutions are transmitted to the MCC. Processing time is evaluated for the LEOLUT in its operational configuration (i.e. when it is configured to process all channels as described in section 3.3).

PT = N - LOS, where N is the time when all solutions are transmitted to the MCC and LOS is the loss of signal. PT shall be less than 15 minutes for 99% of all passes. The minimum, average and maximum processing times for the commissioning period shall be provided.

C.2 406 MHz Statistics

C.2.1 Data Recovery (DR)

$$DR = \frac{\text{Number of received 2.4 kbps frames}}{\text{Number of expected 2.4 kbps frames while satellite is above } 5^{o} \text{ elevation angle}}$$

DR shall be 1.0 or greater for each pass.

This test is required for SARP only commissioning. It is not required for any combined channel processing commissioning.

C.2.2 Location Accuracy

Nominal Solutions

M/N shall be greater than or equal to the following:

0.95 where:

M = number of solutions within 5 km
N = number of solutions

0.98 where:

M = number of solutions within 10 km
N = number of solutions

A histogram for the location accuracy of the correct solutions shall be provided. The histogram shall be in 2 km increments from 0 to 20 km. All solutions with an error greater than 20 km shall be individually listed and an explanation for the error provided.

Marginal Solutions

M/N shall be greater than or equal to the following:

0.60 where:

M = number of solutions within 5 km
N = number of solutions

0.80 where:

M = number of solutions within 20 km
N = number of solutions

Minimum Point Solutions

M/N shall be greater than or equal to the following:

0.60 where:

M = number of solutions within 5 km
N = number of solutions

0.80 where:

M = number of solutions within 20 km
N = number of solutions

Testing the minimum point solution accuracy is only applicable to combined LEO - GEO Processing channel combinations.

A histogram for the location accuracy of the correct solutions shall be provided. The histogram shall be in 5 km increments from 0 to 50 km. All solutions with an error greater than 50 km shall be individually listed and an explanation for the error provided.

C.2.3 Ambiguity Resolution

Nominal Solutions

For the global-mode, the M/N shall be greater than or equal to 0.90, where:

M = number of solutions with correct “A” solution
N = number of solutions

Marginal Solutions

For the global-mode, the M/N shall be greater than or equal to 0.60, where:

M = number of solutions with correct “A” solution
N = number of solutions

C.2.4 Error Ellipse

Nominal Solutions

For the global-mode, the M/N shall be greater than 0.40 and less than 0.60, where:

M = number of solutions for which the actual location falls inside the error ellipse
N = number of solutions

Marginal Solutions

For the global-mode, the M/N shall be greater than 0.40 and less than 0.60, where:

M = number of solutions for which the actual location falls inside the error ellipse
N = number of solutions

C.2.5 Beacon Message Throughput (T)

For each test beacon event calculate:

T = N / (D/R + 1), where:

N = Number of valid messages recovered by the G-SARP
D = Duration of the curve (first valid point to last valid point)
R = Repetition rate of the test beacon

The average value of T for all beacon events shall be 0.75 or greater.

This test is required for G-SARP only commissioning. It is not required for any combined channel processing commissioning.

C.2.6 Probability of Doppler Location (PDL)

PDL = M/N, where:

M = Number of satellite passes with 4 minutes of mutual visibility between the LEOLUT, satellite and test beacon at 5^o elevation angle where a Doppler solution for the test beacon was calculated

N = Total number of satellite passes with 4 minutes of mutual visibility between the LEOLUT, satellite and test beacon at 5^o elevation angle

PDL shall be 0.95 or greater

This test is required for G-SARP only commissioning. It is not required for any combined channel processing commissioning.

C.3 121.5 MHz Statistics

C.3.1 Location Accuracy

Nominal Solutions

For the 121.5 MHz test signal, the M/N shall be greater than or equal to the following:

0.70, where:

M = number of solutions within 20 km
N = number of solutions

0.95, where:

M = number of solutions within 40 km
N = number of solutions

A histogram for the location accuracy of the correct solutions shall be provided. The histogram shall be in 5 km increments from 0 to 50 km. All solutions with an error greater than 50 km and all missed solutions shall be individually listed and an explanation for the error provided. A solution is considered to be missed if no solution was computed although the satellite had mutual visibility of the beacon and the LEOLUT with a CTA between 1^0 and 20^0 for a period of at least 4 minutes including the TCA of the beacon.

C.3.2 Ambiguity Resolution

For the 121.5 MHz test signal, the M/N shall be greater than or equal to 0.70, where:

M = number of solutions with correct "A" solution
N = number of solutions

C.3.3 Error Ellipse

For the 121.5 MHz test signal, the M/N shall be greater than 0.40 and less than 0.60, where:

M = number of solutions for which the actual location falls inside the error ellipse
N = number of solutions

-END OF ANNEX C-

page left blank

ANNEX D

Beacon Simulator Test Script

D.1 Test Messages to be Transmitted

Test Code Sequence	Simulator	Transmit Frequency (MHz)	Date/Time (UTC)	Transmitted 30 Hex Transmitted Code (15 Hex Identifier, bits 26-85)	Number of Bit Errors				Comments
					PDF-1	BCH-1	PDF-2	BCH-2	
Bit Verification (BV)									
BV1	USA	406.025	[TBD]	56EE1100000000037E540000000000	2	0	n/a	n/a	USA, User Test coded beacon with two (2) bit errors introduced at bits 44 and 48 in PDF -1.
BV2	USA	406.027	[TBD]	D6E10E1A4324920458B9D555555555	0	0	0	0	USA, Orbitography beacon with a pattern of “01" in the long message. No bit errors
		406.027		D6E10E1A4324920458B9D555555555	0	0	0	0	Same as above
Message Validation (MV)									
MV1	USA	406.023	[TBD]	D6EE1100000000265F1424DB4CEFBF	2	0	0	2	USA, User Test coded beacon with encoded position (38.855, -76.931) in PDF-1. Two (2) bit errors at bits 44 and 48 in PDF-1. Two (2) bit errors at bits 133 and 134 in BCH-2
		406.023		D6EE0011100000265F1424DB4CE3BF	3	0	0	0	Three (3) bit errors at bits 52, 56 and 60 in PDF-1.
MV2	USA	406.025	[TBD]	96EE0000002729A5E22BB61B842E0A	0	0	0	0	USA, Standard Location Protocol Test coded beacon with encoded position (38.855, -76.931) in PDF-1 and PDF-2.
		406.025		96EE0000002729A5E22BB61B842E0A	0	0	0	0	Same as above
		406.025		96EE0000002729A5E22BB61B842EOA	0	0	0	0	Same as above

Test Code Sequence	Simulator	Transmit Frequency (MHz)	Date/Time (UTC)	Transmitted 30 Hex Transmitted Code (15 Hex Identifier, bits 26-85)	Number of Bit Errors				Comments
					PDF-1	BCH-1	PDF-2	BCH-2	
MV2 (Cont)	USA	406.025	[TBD]	96EE00000029299B91383601261D93	0	0	0	0	Position updated to 40.995 degrees.
		406.025		96EE00000029299B91383601261D9F	0	0	0	2	Two (2) bit errors at bits 141 and 142 in BCH-2.
MV3	USA	406.027	[TBD]	96EF000009B74CE5C3CFF61C080BF5	0	3	0	0	USA, National Location Protocol Test coded beacon with encoded position (38.855, -76.931) in PDF-1 and PDF-2. Three (3) bit errors at bits 88, 96 and 104 in BCH-1.
		406.027		96EF111109B74CE4C2CEF61C080BF5	4	0	0	0	USA, National Location Protocol Test coded beacon with encoded position (38.855, -76.931) in PDF-1 and PDF-2. Four (4) bit errors at bits 44, 48, 52 and 56 in PDF-1.
		406.027		96EF111019B74CE4C2CEF61C080BF5	4	0	0	0	USA, National Location Protocol Test coded beacon with encoded position (38.855, -76.931) in PDF-1 and PDF-2. Four (4) bit errors at bits 44, 48, 52 and 60 in PDF-1.
MV4	USA	406.025	[TBD]	D6EEFEAAAAAAAAA2EA1A24E14CD2B4	3	0	0	0	USA, User Test coded beacon with encoded position (38.855, -76.931) in PDF-2. Three (3) bit errors at bits 42, 44 and 46 in PDF-1.

Test Code Sequence	Simulator	Transmit Frequency (MHz)	Date/Time (UTC)	Transmitted 30 Hex Transmitted Code (15 Hex Identifier, bits 26-85)	Number of Bit Errors				Comments
					PDF-1	BCH-1	PDF-2	BCH-2	
Location Protocol Processing (LP)									
LP1	France	406.025	[TBD]	8E320000007FDFFD0FA4B6000003DD	0	0	0	0	France, Standard Location Protocol MMSI coded beacon with default encoded position in PDF-1 and 0s in PDF-2.
		406.025		8E320000007FDFFD0FA4B6000003DD	0	0	0	0	Same as above
		406.025		8E320000007FDFFD0FA4B6000003DD	0	0	0	0	Same as above
		406.025		8E320000002B8036568C768E010B65	0	0	0	0	France, Standard Location Protocol MMSI coded beacon with encoded position (43.559, 1.482) in PDF-1 and PDF-2
		406.025		8E320000002B8036568C768E010B65	0	0	0	0	Same as above
		406.025		8E320000002B8036568C768E010B65	0	0	0	0	Same as above
LP2	France	406.025	[TBD]	8E3800000AA201776559360F380F6B	0	0	0	0	France, National Location Protocol Serial ELT coded beacon with encoded position (42.559, 1.482) in PDF-1 and PDF-2
		406.025		8E3800000AA201776559360F380F6B	0	0	0	0	Same as above
		406.025		8E3800000AA201776559360F380F6B	0	0	0	0	Same as above
		406.025		8E3800000AE20177ECCB360F380F6B	0	0	0	0	Encoded position updated (43.559, 1.482) in PDF-1
		406.025		8E3800000AE20177ECCB360F380F6B	0	0	0	0	Same as above
		406.025		8E3800000AE20177ECCB360F380F6B	0	0	0	0	Same as above

Test Code Sequence	Simulator	Transmit Frequency (MHz)	Date/Time (UTC)	Transmitted 30 Hex Transmitted Code (15 Hex Identifier, bits 26-85)	Number of Bit Errors				Comments
					PDF-1	BCH-1	PDF-2	BCH-2	
LP3	USA	406.025	[TBD]	D6EE1F1E1E1E1E06A383EFE0FF0146	1	0	0	0	USA, User Test coded beacon with default encoded position in PDF-2. One (1) bit error at bit 48 in PDF-1
		406.025		D6EE1F1E1E1E1E06A383E4E14CD2BE	1	0	0	2	Encoded position updated (38.995, -76.851) in PDF-2. One (1) bit error in bit 48 in PDF-1 and two (2) bit errors at bits 141 and 143 in BCH-2.
		406.025		D6EE1F1E1E1E1E06A383E4E14CD2BE	1	0	0	2	One (1) bit error in bit 48 in PDF-1 and two (2) bit errors at bits 141 and 143 in BCH-2.
		406.025		D6EE1F1E1E1E1E06A383E4E14CD2B4	1	0	0	0	One (1) bit error in bit 48 in PDF-1.
LP4	USA	406.025	[TBD]	96EF000049C14CD260D5F608380389	0	0	0	0	USA, National Location Protocol Test Coded beacon with encoded position (38.995, -76.851).
		406.025		96EF000049C14CD260D5F608380389	0	0	0	0	Same as above.
		406.025		96EFF00049C14CD260D5F608380389	4	0	0	0	Four (4) bit errors at bits 41, 42, 43 and 44 in PDF-1.
		406.025		96EF000049814CD2E947F608380389	0	0	0	0	Encoded position (37.995, -76.851) updated.
		406.025		96EF000049814CD2E947F60838038F	0	0	0	2	Two (2) bit errors in bits 142 and 143.
		406.025		96EF000049814CD2E947F6083803E9	0	0	0	2	Two (2) bit errors in bits 138 and 139.

Test Code Sequence	Simulator	Transmit Frequency (MHz)	Date/Time (UTC)	Transmitted 30 Hex Transmitted Code (15 Hex Identifier, bits 26-85)	Number of Bit Errors				Comments
					PDF-1	BCH-1	PDF-2	BCH-2	
Invalid Beacon Message Processing (IV)									
1V1	France	406.025	[TBD]	8E3FF0004AE2017491D4360F380F6B	4	0	0	0	France, National Location Protocol Test coded beacon with encoded position (43.559, 1.482). Four (4) bit errors at bits 41, 42, 43 and 44.
		406.025		8E3FF0004AE2017493D4360F380F6B	4	1	0	0	France, National Location Protocol Test coded beacon with encoded position (43.559, 1.482). Four (4) bit errors at bits 41, 42, 43 and 44 and One (1) bit error at bit 95.
		406.025		8E3FF0004AE2017493D4360F380F6B	4	1	0	0	Same as above.
		406.025		8E3FF0004AE2017493D4360F380F6B	4	1	0	0	Same as above.
Doppler Processing (DP)									
DP1	France	406.025	[TBD]	4E3EAAAAAAAAAAA057FD8000000000	0	0	0	0	France User Test coded beacon.
		406.025		4E3EAAAAAAAAAAA057FD8000322000	0	0	0	0	Same as above
		406.025		4E3EAAAAAAAAAAA057FD8000000000	0	0	0	0	Multiple errors in PDF-2
DP2	USA	406.025	[TBD]	56EE0000000000477BEAC000000000	0	0	0	0	USA, User Test coded beacon.
		406.025		56EE0000000000477BEAC000000000	0	0	0	0	Same as above
		406.029		56EE0000000000477BEAC000000000	0	0	0	0	Same as above
		406.025		56EE0000000000477BEAC000000000	0	0	0	0	Same as above
		406.025		56EE0000000000477BEAC000000000	0	0	0	0	Same as above

Test Code Sequence	Simulator	Transmit Frequency (MHz)	Date/Time (UTC)	Transmitted 30 Hex Transmitted Code (15 Hex Identifier, bits 26-85)	Number of Bit Errors				Comments
					PDF-1	BCH-1	PDF-2	BCH-2	
DP2 (Cont)	USA	406.025	[TBD]	56EE0000000000477BEAC000000000	0	0	0	0	Same as above
		406.025		56EE0000000000477BEAC000000000	0	0	0	0	Same as above
		406.029		56EE0000000000477BEAC000000000	0	0	0	0	Same as above
		406.025		56EE0000000000477BEAC000000000	0	0	0	0	Same as above
		406.025		56EE0000000000477BEAC000000000	0	0	0	0	Same as above

D.2 Expected Processing

Test Code Sequence	Message to be Transmitted by LEOLUT	Doppler Position	Comments
BV1	56EE0000000000037E540000000000	n/a	LEOLUT should correct two bit errors and transmit corrected message to MCC.
BV2	D6E10E1A4324920458B9D555555555	n/a	LEOLUT should transmit orbitography beacon message without error correcting the long message.
MV1	D6EE0000000000265F1424FFFFFFFF	n/a	LEOLUT corrects both beacon messages (message is confirmed) and transmits corrected message to MCC with bits 113 to 144 set to all "1".
MV2	96EE0000002729A5E22BB61B842E0A	38.855, -76.951	LEOLUT sends the first complete, confirmed message to MCC and calculates Doppler position.
MV3	n/a	n/a	LEOLUT suppresses beacon alert because no valid message exists and no match available for invalid messages.
MV4	n/a	n/a	LEOLUT suppresses beacon alert because no message has 3 bit errors and is not confirmed.
LP1	8E320000002B8036568C768E010B65	43.559, 1.482	LEOLUT sends updated, confirmed message for Standard Location Protocol beacon to MCC.
LP2	8E3800000AE20177ECCB360F380F6B	43.559, 1.482	LEOLUT sends updated, confirmed message for National Location Protocol beacon to MCC.
LP3	D6EE1E1E1E1E1E06A383E4FFFFFFFF	38.855, -76.951	LEOLUT sends valid short message to MCC, however bits 113 to 144 are set to all "1" because PDF-2 is not confirmed.
LP4	96EF000049C14CD260D5F608380389	38.855, -76.951	LEOLUT send s complete, confirmed message to MCC.
IV1	8E3FF0004AE2017491D436FFFFFFFF or 8E3FF0004AE2017493D436FFFFFFFF	43.559, 1.482	LEOLUT calculates Doppler location and sends invalid message to MCC with bits 113 to 144 all set to "1".
DP1	4E3EAAAAAAAAAAA057FD8000000000	43.559, 1.482	LEOLUT should generate Doppler location, set bits 113 to 144 to "0" and transmit to MCC.
DP2	56EE0000000000477BEAC000000000	38.995, -76.851	LEOLUT should eliminate suspect data points and calculate Doppler location.

-END OF ANNEX D-

page left blank

ANNEX E

Data Format

E.1 General

This annex describes the data format to be provided in ASCII format on a disk to the Cospas-Sarsat Secretariat when commissioning a LEOLUT. The data is to be provided in a comma (,) delimited format, and each field shall include an entry. If there is no data for any given field, then a blank space is to be inserted into the appropriate portion of the file. All solution data used in the commissioning testing shall be provided.

A description of the fields is provided below:

Field	Relative position of the data
Description	Description of the information provided
Detailed Format	Guidance on how the data should be provided
Type	C - Character, N - Numeric and L - Logical
Width	The total number of bytes for the field
Dec	The total number of bytes after the decimal
MF#	Message Field as described in C/S A.002 (SID)
Comments	

E.2 Tracking Database

Field	Description	Detailed Format	Type	Width	Dec	MF#	Comments
1	LUT ID	AAAA	C	4		11	
2	Satellite ID	nnn	N	3		6	
3	Orbit Number	nnnnn	N	5		7	
4	LUT AOS Time	YYDDDhhmm	N	9			
5	LUT LOS Time	YYDDDhhmm	N	9			
6	Pass Scheduled	Y or N	L	1			
7	Pass Tracked	Y or N	L	1			
8	Solution from Pass	Y or N	L	1			
9	Manually Scheduled	Y or N	L	1			

E.3 LUT Database for Solution Data

Field	Description	Detailed Format	Type	Width	Dec	MF#	Comments
1	LUT ID		C	4		11	
2	Location Name		C	11			
3	Beacon ID		C	15			Note 1
4	Beacon Message		C	30			
5	Satellite ID	nnn	N	3		6	
6	A Calculated TCA	YYDDDhhmm	N	9		14	Note 2
7	B Calculated TCA	YYDDDhhmm	N	9		14	
8	LUT AOS Time	YYDDDhhmm	N	9			
9	LUT LOS Time	YYDDDhhmm	N	9			
10	Window Factor	n	N	1		15	
11	LUT TPC	YYDDDhhmm	N	9			
12	Message Number	nnnnn	N	5			
13	Transmit Time	YYDDDhhmm	N	9		3	
14	Time of First Data Point Received	snnnn	N	5			Note 3
15	Time of Last Data Point Received	snnnn	N	5			Note 3
16	“A” Latitude	snn.nnn	N	7	3	25	
17	“A” Longitude	snnn.nnn	N	8	3	26	
18	“A” CTA	snn.n	N	5	1	17	
19	“A” Heading	nnn	N	3		27	
20	“A” Semi-Major	nnn.n	N	5	1	27	
21	“A” Semi-Minor	nnn.n	N	5	1	27	
22	“A” Bias (Hz)	snnnnn.n	N	8	1	13	
23	“B” Latitude	snn.nnn	N	7	3	25	
24	“B” Longitude	snnn.nnn	N	8	3	26	
25	“B” CTA	snn.n	N	5	1	17	
26	“B” Heading	nnn	N	3		27	
27	“B” Semi-Major	nnn.n	N	5	1	27	
28	“B” Semi-Minor	nnn.n	N	5	1	27	
29	“A” Probability	nn	N	2		28	
30	Number of Points	nnnn	N	4		21	
31	Confidence Factor	n	N	1		30	Note 4
32	Processing Sources		C	3			Note 5
33	GEOLUT Source		C	4		11	
34	GEOSAR Satellite		C	3			Note 6
35	Comments		C	8			

Notes

1. Beacon ID is not defined for 121.5 MHz beacons. Use default value of 000000000000001 for CW test signal and 00…02, 00…03 etc. for other 121.5 MHz test beacons.
2. For 406 MHz unlocated alerts, use time of last data point.
3. Time in seconds relative to calculated TCA of solution A.

4. Confidence factor of "A" solution. Use 9 if not calculated at LEOLUT.

5. For 406 MHz alerts, indicate each channel source which provided data in the alert as “S” for SARP, “G” for SARR, and/or “C” for Combined with GEOSAR data (e.g. a SARP only solution would be indicated with an “S”, a SARP/SARR solution would be indicated by “SG”, and a SARP/SARR/GEOSAR solution would be indicated by “SGC”).

6. Indicate the first letter for the series of the GEOSAR satellite (e.g. G for GOES) followed by its designator (e.g. G08 would represent GOES-8 and I2A would represent INSAT-2A).

E.4 Beacon Database Description

Field	Description	Detailed Format	Type	Width	Dec	MF#	Comments
1	Beacon Number	nn	N	2			
2	Location		C	11			
3	Beacon ID		C	15			Note 1
4	Latitude of Beacon	snn.nnn	N	7	3	25	
5	Longitude of Beacon	snnn.nnn	N	8	3	26	
6	Type		C	4			Note 2
7	Country		C	3			Note 3
8	Activation Time	YYDDDhhmm	N	9			
9	Deactivation Time	YYDDDhhmm	N	9			
10	Actual “On” Time	YYDDDhhmm	N	9			
11	Actual “Off” Time	YYDDDhhmm	N	9			
12	Comments		C	8			

Notes

1. Beacon ID is not defined for 121.5 MHz beacons. Use default value of 000000000000001 for CW test signal and 00…02, 00…03 etc. for other 121.5 MHz test beacons.

2. UNCO-Uncoded (121.5 MHz)
TEST-Test
ORBI-Orbitography

3. For 121.5 MHz, use XXX.
For 406 MHz, country of beacon registration use the 3 letter abbreviation detailed at Annex I/C of document C/S A.001 (DDP).

-END OF ANNEX E-

page left blank

ANNEX F

Specification for the Cospas-Sarsat 121.5 MHz Standard Test Signal

F.1 GENERAL

The purpose of this document is to define the continuous wave (cw) characteristics for a 121.5 MHz standard test signal to be used during the test phase when commissioning a Cospas-Sarsat Local User Terminal (LUT). This will demonstrate the LEOLUT's ability to detect and locate a 121.5 MHz signal.

F.2 ANTENNA PATTERN

The antenna radiation pattern shall closely approximate an ideal pattern from a whip antenna having vertical linear polarization and be omnidirectional in the horizontal plane.

F.3 CARRIER

The frequency of the cw signal shall be between 121.506 MHz and 121.508 MHz. The carrier shall have a frequency stability defined by the mean slope of the frequency versus time over a 15 minute period and by the residual frequency variation about the mean slope. The mean slope shall not exceed 1 part in 10 raised to the power 9 per minute. The residual frequency variation shall not exceed 3 parts in 10 raised to the power 9.

F.4 OUTPUT POWER

The equivalent isotropically radiated power (EIRP) from the antenna at 20^{o} elevation angle shall be 10 milliwatts. The output power level shall remain constant within 1 dB for the duration of the test.

F.5 UNWANTED SIGNALS

The output shall be such that there are no unwanted signals above minus 25 dB relative to the carrier (i.e. - 25 dBc).

-END OF ANNEX F-

page left blank

ANNEX G

LEOLUT* Commissioning - Principles and Policies

G.1 References

The Cospas-Sarsat Council approved the general principles of its commissioning policy for LEOLUTs, provided hereunder in sections G.2, G.3 and G.4.

G.2 General

The following principles govern the commissioning of Cospas-Sarsat Ground Segment equipment:

G.2.1 A State which has notified its association with the Cospas-Sarsat Programme as a Ground Segment Provider assumes the responsibility "to adhere to the technical specifications and operating procedures set by the Council for the purpose of ensuring adequate System performance" and "to provide, as agreed with the Council, appropriate performance data in order to confirm compatibility of its Ground Segment equipment with the System" (section 3.1 of the Letter of Notification).

G.2.2 Cospas-Sarsat performance standards and design guidelines for LEOLUTs and MCCs are defined in documents C/S T.002 and C/S A.005, respectively.

G.2.3 Cospas-Sarsat criteria and test methods for verifying that LEOLUTs and MCCs meet these standards are defined in documents C/S T.005 and C/S A.006, respectively.

G.2.4 The responsible Agency or Administration installing and planning to operate a new LEOLUT or MCC shall plan and conduct appropriate tests, in accordance with the applicable Cospas-Sarsat standards, which may form part of its own acceptance testing.

G.2.5 A commissioning report, including the results of the commissioning tests defined by Cospas-Sarsat, shall be submitted to the Cospas-Sarsat Secretariat, for review by the Joint Committee.

G.2.6 After review of the commissioning report, the Joint Committee makes appropriate recommendations to the Cospas-Sarsat Council. Formal commissioning is recorded at the subsequent Council meeting, after approval of the Joint Committee recommendation by the Council.

---

* All references to LUT have been changed to LEOLUT to make clear the differences between the LEO and GEO Search and Rescue ground stations.

G.2.7 This commissioning and reporting procedure shall be implemented by all Cospas-Sarsat Ground Segment operators, including Parties to the International Cospas-Sarsat Programme Agreement, for commissioning new LEOLUTs and MCCs or new equipment or functions which have a significant impact on the Cospas-Sarsat Ground Segment operation.

G.2.8 The cost of implementing the commissioning procedure and reporting to the Cospas-Sarsat Joint Committee is borne by the operating Agency or Administration installing the equipment to be commissioned.

G.2.9 Ground Segment equipment will be commissioned into the Cospas-Sarsat System only if the formal association of the LEOLUT and MCC operator with the Cospas-Sarsat Programme has been notified in accordance with the standard procedure, unless otherwise agreed by the Council.

G.3 LUT COMMISSIONING

The following principles govern the implementation of the Cospas-Sarsat LEOLUT Commissioning Standard (C/S T.005):

G.3.1 The implementation of the commissioning procedure defined in document C/S T.005 is the responsibility of the operating Agency or Administration.

G.3.2 The operating Agency or Administration will be responsible for equipment which may be required for performing the commissioning tests.

G.3.3 A LEOLUT may be commissioned as a stand-alone system, independent of an MCC. However, LEOLUT commissioning may take place at the same time that the associated MCC is being commissioned.

G.3.4 The LEOLUT/MCC interface is part of the LEOLUT commissioning. Therefore, it shall be tested as part of the LEOLUT commissioning procedure.

G.3.5 If the test results in the commissioning report submitted by the operating Agency or Administration do not demonstrate full compliance with the LEOLUT Performance Specification (C/S T.002), corrective action shall be taken.

G.3.6 If the test results in the commissioning report submitted by the operating Agency or Administration do demonstrate full compliance with the LEOLUT Performance Specification (C/S T.002), the alert data derived from the new LEOLUT can be immediately used by the associated MCC for distribution in accordance with the Cospas-Sarsat Data Distribution Plan (C/S A.001).

G.3.7 Once the alert data derived from the new LEOLUT begins to be used by the associated MCC, a change of System status shall be notified to all MCCs by the associated MCC, in accordance with the procedure of document C/S A.001.

G.3.8 The Joint Committee shall, at its following meeting, review the commissioning report and recommend to the Cospas-Sarsat Council, as appropriate, formal commissioning of the LEOLUT.

G.4 STATUS OF THE COSPAS-SARSAT GROUND SEGMENT

G.4.1 After their commissioning, LEOLUTs are listed and described as appropriate in the applicable System documents and the "Cospas-Sarsat System Data" document.

G.4.2 The Cospas-Sarsat LEOLUTs commissioned in the Cospas-Sarsat System shall be listed in an annex to the document C/S A.001 "Cospas-Sarsat Data Distribution Plan".

-END OF ANNEX G-

page left blank

ANNEX H

Guidelines for Integration of New LEOLUTs in the Cospas-Sarsat System

The introduction of new LEOLUTs in the Cospas-Sarsat System is supervised by the Technical Working Group (TWG) of the Cospas-Sarsat Joint Committee whose objectives include:

a) the improvement of the overall performance of the Cospas-Sarsat Ground Segment; and
b) the technical control of the development of the Cospas-Sarsat LUTs.

The guidelines hereunder, and Figure H.1, provide procedures for integrating a new LEOLUT into the Cospas-Sarsat Ground Segment.

1. Installation of New Equipment - The new LEOLUT(s) equipment should be sited to allow the widest possible horizon and to maximize coverage of national SRRs as well as the entire Cospas-Sarsat System. The location of the LEOLUT(s) should also allow for reliable communications with the associated MCC.

2. Ground Segment Description and LEOLUT Coverage - The national Administration should ensure that a description of the new LEOLUT(s) along with (1) coordinates, (2) address, (3) frequencies and (4) LEOLUT antenna masks are provided to the Cospas-Sarsat Secretariat.

   The national Administration should also ensure that their LEOLUT(s) are properly registered with the International Telecommunications Union (ITU). The forms provided in Annex I to this document should be completed and forwarded to ITU through the appropriate national authorities.

3. Commissioning Test - For new Ground Segment Providers, the LEOLUT Commissioning tests may be scheduled to coincide with the MCC commissioning tests. In any case, the LEOLUT should be connected to the MCC and tested in its operational configuration processing all channels identified in section 3.3 of this document. However, statistics for the different channels may be collected separately.

   The LEOLUT Operator should ensure that test beacon(s) capable of transmitting the test code sequences contained in Annex D is (are) available for the commissioning test, or the LEOLUT Operator should coordinate with beacon simulator providers in the USA or France for the transmission of such code sequences. If test beacons/simulators cannot be used during the commissioning test, the LEOLUT Operator should ensure that an alternative method of confirming compliance is identified.

The relevant sections of this document describe the operational, functional and processing, and performance requirements to be tested. During the test, the data from the LEOLUT(s) should be transmitted to the associated MCC, however, the data should be suppressed by the MCC and not transmitted within the Cospas-Sarsat System.

4. Preparation of Commissioning Report - The results of the tests, along with the proper declarations and verifications for items not specifically tested, should be documented in a commissioning report. Annex A to this document contains the format of the commissioning report.

   The commissioning report should include as a minimum the information requested in this document and in the format contained in Annex A. In addition, information to explain or clarify results should also be included in the commissioning report.

   Any anomaly, or failure to meet a requirement, observed during the commissioning test should be corrected and the requirement re-tested. After the LEOLUT satisfies the requirements of document C/S T.002 "Cospas-Sarsat LEOLUT Performance Specification and Design Guidelines," the completed commissioning report should be submitted by the national Administration to the Cospas-Sarsat Secretariat.

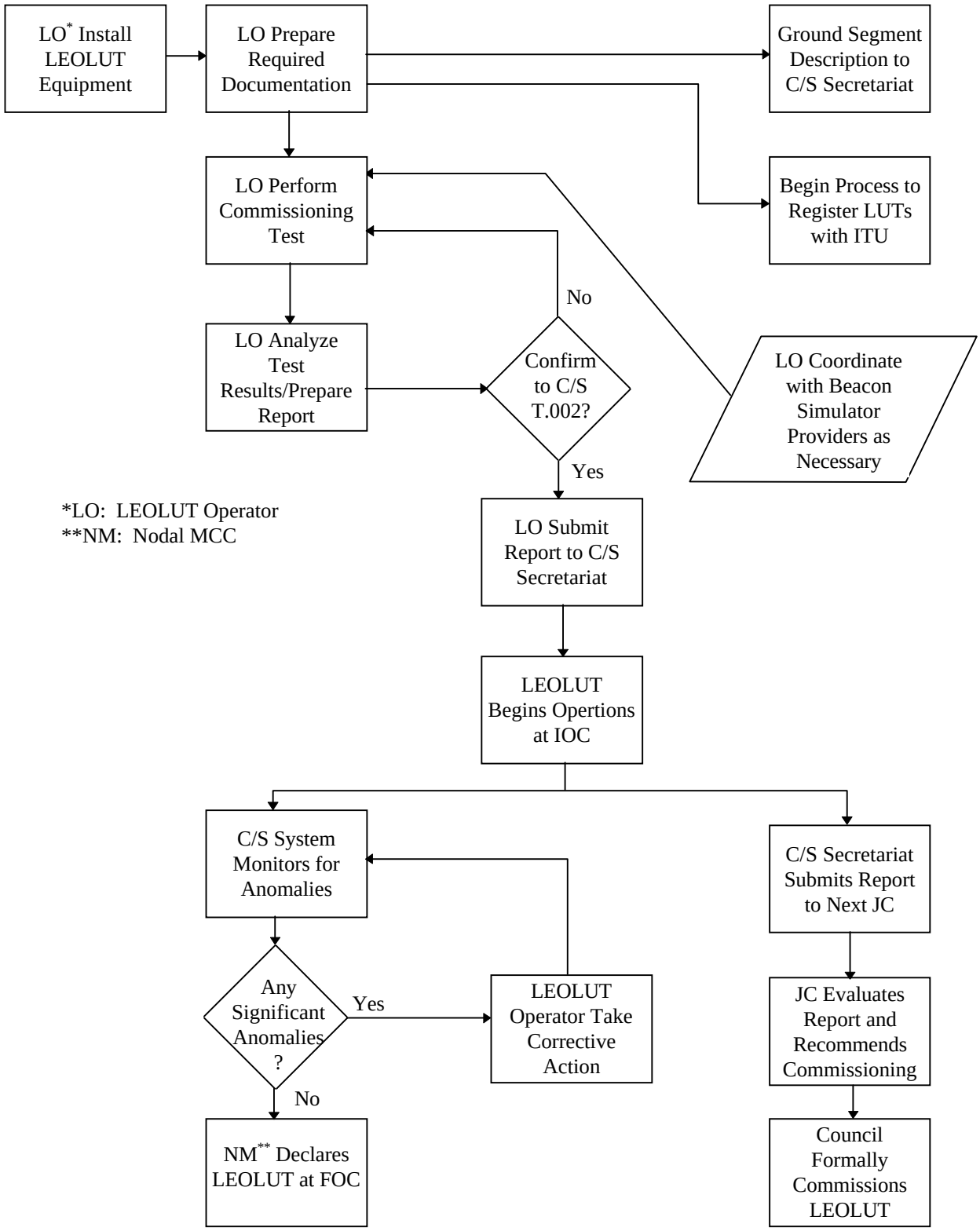
5. Initial Operational Capability (IOC) - If the commissioning test has been completed successfully, and the commissioning report has been forwarded to the Cospas-Sarsat Secretariat, the LEOLUT may begin operations in an IOC status. However, the LEOLUT cannot reach IOC status prior to the MCC IOC date if the associated MCC is also in the commissioning process. The national Administration, through its associated MCC, should notify all Ground Segment Operators of a LEOLUT's IOC status via a System Status message.

   The IOC phase allows a thorough review of the LEOLUT performance. However a LEOLUT shall not remain in an IOC phase for more than one year. LEOLUTs that have not reached FOC within one year will be considered not operational, and documented as "Under Development". To regain IOC status the LEOLUT will require a retest of the elements which prevented it from reaching FOC. The LEOLUT then must operate again in an IOC phase prior to reaching FOC. All Cospas-Sarsat Ground Segment Operators should monitor the data from new LEOLUTs for any significant anomalies that could impact Cospas-Sarsat operations.

6. Full Operational Capability (FOC) - If after 90 days of operation in an IOC state no anomalies are detected in the performance of the LEOLUT, the LEOLUT should be declared at FOC by the appropriate nodal MCC. The transition of a LEOLUT from an IOC status to a FOC status ensures that the LEOLUT performs to Cospas-Sarsat standards and does not negatively impact System operations.

7. Formal Commissioning - The Joint Committee reviews the commissioning report and, pending additional details or explanations, submits the report to the Cospas-Sarsat Council. The Council accepts the commissioning report and the LEOLUT is formally commissioned in the Cospas-Sarsat Ground Segment.

Figure H.1: Overview of LEOLUT Integration



-END OF ANNEX H-

page left blank

ANNEX I

Guidelines for Registration of New LEOLUTs with ITU

INSTRUCTIONS FOR FILLING THE FORM OF NOTICE ApS4/III
FOR REGISTRATION OF COSPAS-SARSAT LEOLUTS WITH ITU

NOTES:

- The form ApS4/III provided at appendix 1 to this Annex is to be completed by each national administration or agency operating Cospas-Sarsat LEOLUTs, for each LUT and each satellite network (i.e. KOSPAS and SAR).
- Plain characters in the description below reproduce the text of ITU BR Circular Letter CR/65. *Comments by the Secretariat are in Italics.*
- Different information is required for registering GEOLUTs. In particular, GEOLUTs cannot be associated with the KOSPAS and SAR networks as notified to ITU.
- An electronic version of this form can be obtained at http://www.itu.int/itudoc/itu-r/cl/cr/cr-58/

HEADER:

DATE	Date of submission by notifying administration for its own use.
Administration serial number	Serial/reference number given by the notifying administration for its own use.
A1f. NOTIFYING ADMINISTRATION	The country symbol designating the notifying administration and the symbol designating the international satellite system, if appropriate. *Note that the three letter symbol designating the country is different from the Cospas-Sarsat three letter abbreviation given in the DDP Annex I/C. The ITU three letter country symbol is given in Table B1 of the Preface to the International Frequency List (IFL). Cospas-Sarsat has not been declared as an international system and no abbreviation has been assigned, so the second part of this field should not be completed.*
RR1488	*Indicate with a **X** that this is a Notification.*
RR1107 and RR1610	*To be left blank.*
RS46	*Not applicable to Cospas-Sarsat LEOLUTs.*
NOTIFICATION INTENDED FOR ADDITION	*To be indicated with the letter **A** for a "new" earth station (not previously notified). Letters **M** or **S** are to be used for modification or suppression of earth stations previously notified.*
BR IDENTIFICATION NO. OF STATION TO BE MODIFIED / SUPPRESSED	*To be used only in case of modification or suppression of earth stations previously notified.*

SECTION 1: CHARACTERISTICS OF EARTH STATION

A1e1. TYPE	*Indicate Specific with letter **S**.*
A1e2. NAME OF EARTH STATION	*Enter name of LEOLUT.*
A1e3a. COUNTRY	Indicate the country in which the station is located using the appropriate symbol given in Table No. B1 of the Preface to the IFL or the SRS. *In most cases this is the same symbol as in field A1f).*
A1e3b. GEOGRAPHICAL COORDINATES	*Specific to the LEOLUT*.
A4c1. ASSOCIATED SPACE STATION	***KOSPAS** or **SAR**.*
A4c2. NOMINAL ORBITAL LONGITUDE	*Not applicable, leave blank*.
A7a. HORIZON ELEVATION DIAGRAM	Enter the number of the attachment containing the diagram indicating the horizon elevation angle for each azimuth around the station (instructions for presentation of graphical data are given in IFRB circular letter No. 769 of 23 December 1988); or **alternatively**, fill in the table provided for the values of horizon elevation angle *(**A7a TABLE OF VALUES FOR THE HORIZON ELEVATION**)*. In this case it is not necessary to fill in values for each 5 or 10 degrees of azimuth; only changes in the horizon elevation angle need be indicated. Thus, for example, if the horizon elevation angle has a constant value of 1.5 degrees between azimuths of 50 and 180 degrees only two entries are required in the table; one for an azimuth of 50 degrees and one for an azimuth of 180 degrees. In addition, if for two consecutive values of azimuth in the table, the horizon elevation angles are different, intermediate values will be calculated by linear interpolation.
A7b. ELEVATION ANGLE	Enter the planned minimum operating angle of elevation of the antenna on the direction of maximum radiation towards the associated space station, expressed in decimal degrees from the horizontal plane. *In the case of Cospas-Sarsat LEOLUTs this elevation angle should be **0.0** degrees or the minimum value (over 0) specified in Table A7a.*
A7c. OPERATING AZIMUTHAL ANGLES	Enter the planned range of operating azimuthal angles for the direction of maximum radiation, each value expressed in decimal degrees clockwise from True North. *In the case of Cospas-Sarsat LEOLUTs these values should be **0.0** to **360.0** degrees.*
A7d. ALTITUDE	Enter the height of the centre of the antenna above mean sea level, expressed in metres. *This information is specific to each Cospas-Sarsat LEOLUT.*
A10. COORDINATING AREA DIAGRAMS	*Not necessary for Cospas-Sarsat LEOLUTs.*

SECTION 2: TRANSMITTING EARTH STATION CHARACTERISTICS

Not applicable to Cospas-Sarsat LEOLUTs, pages ApS4/III - 2a and 2b are not to be completed nor forwarded to the ITU.

SECTION 3: RECEIVING EARTH STATION CHARACTERISTICS

	CHARACTERISTICS OF THE ANTENNA
B1. ASSOCIATED SATELLITE TRANSMITTING BEAM DESIGNATION	Enter the receiving beam designation by a symbol consisting of up to four characters. *For Cospas-Sarsat LEOLUTs, enter **T1**.*
ADD/MOD/SUP/REP of the antenna	*Leave blank.*
OLD BEAM DESIGNATION	*Leave blank.*
B5. EARTH STATION ANTENNA CHARACTERISTICS	
a. MAXIMUM ISOTROPIC GAIN	Enter the appropriate sign (+ or -) followed by the isotropic gain (Gi see RR154) of the antenna in the direction of maximum radiation, expressed in dBi. *Enter value specific to the LEOLUT antenna, as specified by the manufacturer. For example, Bundaberg LUT was notified as +25.9 dBi, other Cospas-Sarsat LEOLUTs could have figures of about +30.0 dBi.*
b. BEAMWIDTH	Enter the total beamwidth at the mean half-power points of the main lobe, expressed in decimal degrees. *Enter value specific to the LEOLUT antenna, as specified by the manufacturer. For example, Bundaberg LUT was notified with 8.00 degrees beamwidth, other Cospas-Sarsat LEOLUTs could have beamwidth of about 5.00 degrees.*
C1. ANTENNA RADIATION PATTERN DIAGRAM. SEE ATTACHMENT No.	*If available, enter the attachment number where the measured radiation diagram of the LUT antenna is provided. This is NOT required for Cospas-Sarsat LEOLUTs and, alternatively, the radiation pattern symbol can be entered in c2.*
C2. RADIATION PATTERN	Indicate the reference radiation pattern (from table in BR Circular CR/65 and the Preface to IFL or SRS). *Note that if the radiation pattern had been provided as an attachment, then this should be left blank.* *The symbol **AP29** can be used for Cospas-Sarsat LEOLUTs. It refers to Annex 3 to Appendix 29 of the RR (Radiation Patterns for Earth Station Antennae to Be Used When They Are Not Published).*
FOR NON STANDARD ANTENNA PROVIDE …	*Leave blank.*

	INFORMATION COMMON TO THE FOLLOWING GROUPS (LISTS) OF ASSIGNED FREQUENCIES OF THIS ANTENNA
A2a. DATE OF BRINGING INTO USE	*Enter date of commissioning or expected date of operation (dd/mm/yy).*
A3a. OPERATING AGENCY OR COMPANY	Using symbols from Table No. 12A/12B of the Preface to the IFL or SRS, indicate the operating agency or company and the postal and telegraphic addresses of the administration to which communications should be sent on urgent matters regarding interference, quality of emissions, and questions referring to the technical operation of stations (see Article 22 of the RR). If there is no symbol in Table No. 12A/12B of the Preface corresponding to the administration or agency concerned, spell out the name in box REMARKS with reference to box A3a or A3b as applicable, and the Bureau will provide the symbol. *The Preface to the SRS is available in CD form at the Secretariat, information on existing symbols, as recorded for each country in the Preface, can be provided on request. For example, the symbols given in the Preface to the Space Radiocommunications Stations are:* - *005 for INTA, Spain* - *018 for CNES, France* - *003 for National Defence, Algeria* - *027 for Ministry of Transport, London, UK*
A3b. ADMINISTRATION RESPONSIBLE FOR THE STATION	*Enter **A** if the operating agency is an administration, refer to Tables 12A/12B of the Preface otherwise.*
SPECIAL SECTION AR11/A (RR1042)	Enter the number of the Special Section of the Weekly Circular in which the advance information was published under Section I of Article 11. *This box should be left blank and references to advance publications of the satellite networks provided in OTHER SPECIAL SECTIONS (see below).*
SPECIAL SECTION AR11/C (RR1060)	*Leave blank.*
SPECIAL SECTION ART.14 (RR1610)	*Leave blank.*
OTHER SPECIAL SECTIONS	- *Forms in respect of the KOSPAS network, enter:* *in column reference, in column number* *(1)* ***SPA-AA*** ***259*** *(2)* ***SPA-AA*** ***295*** - *Forms in respect of the SAR network, enter:* *in column reference, in column number* *(1)* ***SPA-AA*** ***223*** *(2)* ***SPA-AA*** ***281***
A6/A7. COORDINATED WITH OR AGREEMENT REACHED WITH	*Leave blank.*

A6/A7. COORDINATION REQUESTED WITH OR AGREEMENT SOUGHT WITH	*Leave blank.*
REMARKS	*Leave blank.*

End of page ApS4/III - 3a

SATELLITE TRANSMITTING BEAM DESIGNATION	*Enter the symbol **T1***
BR IDENTIFICATION NUMBER OF GROUP (LIST) OF FREQUENCIES TO BE MODIFIED / SUPPRESSED / REPLACED	*To be used only in case of modification or suppression of group of assigned frequencies previously notified. Leave blank for notification of LEOLUTs not previously registered.*
ADD / **M**OD / **S**UP / **R**EP	*Enter the symbol **A***
	CHARACTERISTICS COMMON TO THE FOLLOWING GROUP (LIST) OF ASSIGNED FREQUENCIES
C4a. CLASS OF STATION	Indicate the appropriate class of station and the nature of service, using the symbols given in Tables Nos. 6A1 and 6B1 respectively of the Preface to the IFL and the SRS. Up to four pairs of values can be provided *For Cospas-Sarsat LEOLUTs, enter the symbols:* *- **TB** which designates aeronautical earth stations,* *- **TI** which designates coast earth stations,*
C4b. NATURE OF SERVICE	*For Cospas-Sarsat LEOLUTs, enter the symbols:* *- **FS** i.e. a land station established solely for the safety of life, and* *- **OT** i.e. a station open exclusively to the operational traffic of the service concerned.*
C6. POLARIZATION	Enter the symbol for the type of polarization in the first box (see Table No. 9D1 of the Preface to the IFL and the SRS). *For Cospas-Sarsat LEOLUTs, enter the symbol **CL** which indicates a left-hand circular polarization. Leave the second box (if linear, …) blank.*
C3a. ASSIGNED FREQUENCY BAND	Enter the bandwidth of the assigned frequency band as defined in RR141, expressed in KHz. The assigned frequency band should in no case exceed the bandwidth of a single satellite transponder. *Enter the figure **800** (kHz) for Sarsat satellites and **1000** (kHz) for Cospas satellites, or the value specific to the LEOLUT if different.*

C5b. RECEIVING SYSTEM NOISE TEMPERATURE	Enter the value of the lowest total receiving noise temperature expressed in kelvins, referred to the output of the earth station antenna under clear sky conditions. *This data is specific to the LUT and should be obtained from the LUT manufacturer.*
	EMISSIONS RECEIVED BY THE ASSIGNED FREQUENCIES LISTED BELOW
C7a. DESIGNATION OF EMISSION	Indicate the necessary bandwidth (RR146) and class of emission (RR133) in accordance with Article 4 and Appendix 6. *For the KOSPAS network the registered data for the T1 frequency beam shows 1M00FXX. For the SAR network the registered data for the T1 frequency beam shows 800KFXX. However, the best description of the class of emission received by the LUT is G9D. Therefore, for Cospas-Sarsat LEOLUTs, the designation of emission to be entered is **1M00G9D** for Kospas network and **800KG9D** for SAR network.*
C8e. C/N Objective (total - clear sky)	Enter the required carrier to noise ratio, in decibels, for the overall link for each carrier when clear sky propagation conditions apply. *This data is specific to the LUT and should be obtained from the LUT manufacturer.*
	GROUP (LIST) OF ASSIGNED FREQUENCIES HAVING THE ABOVE COMMON CHARACTERISTICS
C2a. ASSIGNED FREQUENCY	*The value **1544.5** should be entered as shown at Annex 3 with the letter **M** (for MHz) in the last box.*

End of page ApS4/III - 3b
End of form

APPENDIX 1 TO ANNEX I

DATE (Day/Month/Year) d d / m m / y y	FORM OF NOTICE EARTH STATION (APPENDIX S4 - ANNEX 2A)	PAGE 1 OF 3	ApS4/III
Administration Serial Number			

A1f. NOTIFYING ADMINISTRATION	RR1488	RR1107	RR1610	Request for Assistance of the BR for	NOTIFICATION INTENDED FOR
A B C /	Notification x	Request for Coordination	Agreement under Art.14	RR1107 and/or RR1610	ADDITION MODIFICATION SUPPRESSION A
FIRST NOTIFICATION x RESUBMISSION		RS 46 Request for Coordination		BR IDENTIFICATION NO. OF STATION TO BE MODIFIED / SUPPRESSED	

1. CHARACTERISTICS OF THE EARTH STATION

A1e1. TYPE (Specific/Typical) S

A1e2. NAME OF THE EARTH STATION Name of LUT

A1e3a. COUNTRY[1] ABC

Or the code for the location of LEOLUT as identified in the preface to the IFL if different from A1f

A1e3b. GEOGRAPHICAL COORDINATES[1]

Longitude				Latitude			
Degrees	E/W	Min.	Sec.	Deg.	N/S	Min.	Sec.
d d d	X	m m	s s	d d	X	m m	s s

A4c1. ASSOCIATED SPACE STATION KOSPAS or SAR

A4c2. NOMINAL ORBITAL LONGITUDE (if geostationary)

Degrees	E/W
●	

A7a. HORIZON ELEVATION DIAGRAM SEE ATTACHMENT NO.[1]

A7b. ELEVATION ANGLE[1] Degrees 0 0 ● 0

A7c. OPERATING AZIMUTHAL ANGLES[1]

FROM (Degrees)	TO (Degrees)
0 0 0 ● 0	3 6 0 ● 0

A7d. ALTITUDE[1] Metres m m m

A10. COORDINATION AREA DIAGRAMS SEE ATTACHMENT NO.

A7a. TABLE OF VALUES FOR THE HORIZON ELEVATION[1] *(To be completed - See Annex I)*

AZIMUTH	ELEVATION ANGLE Degrees	AZIMUTH	ELEVATION ANGLE Degrees	AZIMUTH	ELEVATION ANGLE Degrees	AZIMUTH	ELEVATION ANGLE Degrees	AZIMUTH	ELEVATION ANGLE Degrees	AZIMUTH	ELEVATION ANGLE Degrees
	●		●		●		●		●		●
	●		●		●		●		●		●
	●		●		●		●		●		●
	●		●		●		●		●		●
	●		●		●		●		●		●
	●		●		●		●		●		●

GENERAL NOTES :

i. This form of notice consists of three parts - 1, 2, and 3 - as indicated below :
   1 - Characteristics of the earth station
   2 - Transmitting earth station characteristics and
   3 - Receiving earth station characteristics.
   In each part, each information item/data field includes a number in its label. This number is the same as that used for the same item in Appendix S4 (WRC-95) within the same part. For example, on the page labelled "Form ApS4/III - 2a" (at the bottom), the field "A2a. Date of bringing into use" is the item numbered 2a in Part A of Annex 2A to Appendix S4.

ii. Data items that are related are grouped together in a box. For example, the page labelled "Form ApS4/III - 2b" (at the bottom) contains a box titled "Emissions common to the assigned frequencies listed below". It is possible to specify 12 different emissions (with associated power and power density values) in this box. If there are more emissions, use another page of the same type to provide additional data, after checking ($\surd$) the field labelled 'More emissions on next page" on the preceding page. In all cases where there is more information than can fit in a box, follow this procedure.

iii. This form can be used to add, modify or suppress an existing station, by entering **A**, **M** or **S** in the box at the top right-hand corner of this page in the area titled "Notification intended for". In the case of a modification of an existing station, where certain data fields are to be added, modified or suppressed, provide ALL the data in the particular box as they would look after the change. In addition, indicate that the corresponding antenna or group of frequencies is being modified by entering **M** or **R** in the field that has been provided for this purpose at these levels.

iv. Certain fields in this notice form have a superscript "1"as part of their labels. This has the following meaning :
   1 - This information is not required for the notification of a typical earth station.

Do not send this page to the ITU

2. TRANSMITTING EARTH STATION CHARACTERISTICS

PAGE ____ OF ____

CHARACTERISTICS OF THE ANTENNA

ADD / MOD / SUP / REP of the antenna

B1. ASSOCIATED SATELLITE RECEIVING BEAM DESIGNATION

NOTE: For a steerable beam, the last character of the beam designation shall be "R"

OLD BEAM DESIGNATION (if changed)

B5. EARTH STATION ANTENNA CHARACTERISTICS

a. MAXIMUM ISOTROPIC GAIN (+/- dBi)

b. BEAMWIDTH (Degrees)

c1. ANTENNA RADIATION PATTERN DIAGRAM. SEE ATTACHMENT NO.

c2. RADIATION PATTERN (give reference pattern or provide diagram)

FOR NON-STANDARD ANTENNA PROVIDE:

Coefficient A	Coefficient B	Coefficient C	Coefficient D	PHI1
dBi	dBi	dBi	dBi	Degrees
•	•	•	•	•

INFORMATION COMMON TO THE FOLLOWING GROUPS (LISTS) OF ASSIGNED FREQUENCIES OF THIS ANTENNA

A2a. DATE OF BRINGING INTO USE (Day / Month / Year)

A3a. OPERATING AGENCY OR COMPANY (Refer to Table 12A/12B of the Preface to the IFL & SRS)

A3b. ADMINISTRATION RESPONSIBLE FOR THE STATION (Refer to Table 12A/12B of the Preface to the IFL & SRS)

SPECIAL SECTION AR11/A (RR1042)
A R 1 1 / A / Number

SPECIAL SECTION AR11/C (RR1060)
A R 1 1 / C / Number

SPECIAL SECTION ART.14 (RR1610)
A R 1 4 / C / Number

OTHER SPECIAL SECTIONS

	Reference	Number
(1)		
(2)		
(3)		
(4)		
(5)		

A6/A7. COORDINATED WITH OR AGREEMENT REACHED WITH

RR Provision	Symbols of the Administrations concerned
R R	
R R	
R R	
R R	
R R	

A6/A7. COORDINATION REQUESTED WITH OR AGREEMENT SOUGHT WITH

RR Provision	Symbols of the Administrations concerned
R R	
R R	
R R	
R R	
R R	

REMARKS

NOTES ON FILLING IN THE NEXT PAGES:

FOR EACH ANTENNA YOU MAY PROVIDE ONE OR MORE GROUPS (LISTS) OF ASSIGNED FREQUENCIES, EACH GROUP (LIST) HAVING ONE SET OF COMMON CHARACTERISTICS. THE BOTTOM HALF OF THIS PAGE CONTAINS COMMON DATA THAT IS APPLICABLE TO ONE OR MORE GROUPS (LISTS) OF FREQUENCIES OF THIS ANTENNA. FOR EACH GROUP (LIST) OF FREQUENCIES OF THIS ANTENNA, FIRST FILL IN THE SET OF COMMON CHARACTERISTICS, FOLLOWED BY THE GROUP (LIST) OF FREQUENCIES TO WHICH THE SET APPLIES. USE AS MANY PAGES AS NECESSARY.

Do not send this page to the ITU

SATELLITE RECEIVING BEAM DESIGNATION

PAGE OF

BR IDENTIFICATION NUMBER OF GROUP (LIST) OF FREQUENCIES TO BE MODIFIED / SUPPRESSED / REPLACED

ADD / MOD / SUP / REP of the group

CHARACTERISTICS COMMON TO THE FOLLOWING GROUP (LIST) OF ASSIGNED FREQUENCIES

C4a. CLASS OF STATION

C4b. NATURE OF SERVICE

C6. POLARIZATION

TYPE

if linear, provide angle in degrees

C3a. ASSIGNED FREQUENCY BAND (kHz)

C8g. MAXIMUM AGGREGATE POWER +/- dBW

EMISSIONS COMMON TO THE ASSIGNED FREQUENCIES LISTED BELOW

C7a. DESIGNATION OF EMISSION	C8a1/C8b1. * MAXIMUM PEAK POWER +/- dBW	C8a2/C8b2. * MAXIMUM POWER DENSITY +/- dBW/Hz	C8c1. MINIMUM PEAK POWER +/- dBW	C8c2. MINIMUM POWER DENSITY +/- dBW/Hz

* If maximum peak power and maximum power density values are of type C8b, check this box

MORE EMISSIONS ON NEXT PAGE

Reason for minimum peak power and minimum power density (C8c) values being absent; see attachment No.

GROUP (LIST) OF ASSIGNED FREQUENCIES HAVING THE ABOVE COMMON CHARACTERISTICS

C2a. ASSIGNED FREQUENCY k/M/G Hz	C2a. ASSIGNED FREQUENCY k/M/G Hz

MORE ON NEXT PAGE

Form ApS4/III - 2b

3. RECEIVING EARTH STATION CHARACTERISTICS

PAGE 2 OF 3

CHARACTERISTICS OF THE ANTENNA

ADD / MOD / SUP / REP of the antenna

B1. ASSOCIATED SATELLITE TRANSMITTING BEAM DESIGNATION: T1

NOTE: For a steerable beam, the last character of the beam designation shall be "R"

OLD BEAM DESIGNATION (if changed)

B5. EARTH STATION ANTENNA CHARACTERISTICS

a. MAXIMUM ISOTROPIC GAIN: +/- dBi

b. BEAMWIDTH: Degrees

c1. ANTENNA RADIATION PATTERN DIAGRAM. SEE ATTACHMENT NO.

c2. RADIATION PATTERN (give reference pattern or provide diagram): AP29

FOR NON-STANDARD ANTENNA PROVIDE:

Coefficient A	Coefficient B	Coefficient C	Coefficient D	PHI1
dBi	dBi	dBi	dBi	Degrees

Not to be completed if antenna radiation pattern diagram has been included with submission

INFORMATION COMMON TO THE FOLLOWING GROUPS (LISTS) OF ASSIGNED FREQUENCIES OF THIS ANTENNA

A2a. DATE OF BRINGING INTO USE: Day dd Month mm Year yy

A3a. OPERATING AGENCY OR COMPANY (Refer to Table 12A/12B of the Preface to the IFL & SRS)

A3b. ADMINISTRATION RESPONSIBLE FOR THE STATION (Refer to Table 12A/12B of the Preface to the IFL & SRS): A

SPECIAL SECTION AR11/A (RR1042) Number: AR11/A/

SPECIAL SECTION AR11/C (RR1060) Number: AR11/C/

SPECIAL SECTION ART.14 (RR1610) Number: AR14/C/

OTHER SPECIAL SECTIONS

	Reference	Number
(1)	SPA-AA	259
(2)	SPA-AA	295
(3)		
(4)		
(5)		

Or 223 and 281 for SAR

A6/A7. COORDINATED WITH OR AGREEMENT REACHED WITH

RR Provision	Symbols of the Administrations concerned
RR	
RR	
RR	
RR	
RR	

A6/A7. COORDINATION REQUESTED WITH OR AGREEMENT SOUGHT WITH

RR Provision	Symbols of the Administrations concerned
RR	
RR	
RR	
RR	
RR	

REMARKS

NOTES ON FILLING IN THE NEXT PAGES:

FOR EACH ANTENNA YOU MAY PROVIDE ONE OR MORE GROUPS (LISTS) OF ASSIGNED FREQUENCIES, EACH GROUP (LIST) HAVING ONE SET OF COMMON CHARACTERISTICS. THE BOTTOM HALF OF THIS PAGE CONTAINS COMMON DATA THAT IS APPLICABLE TO ONE OR MORE GROUPS (LISTS) OF FREQUENCIES OF THIS ANTENNA. FOR EACH GROUP (LIST) OF FREQUENCIES OF THIS ANTENNA, FIRST FILL IN THE SET OF COMMON CHARACTERISTICS, FOLLOWED BY THE GROUP (LIST) OF FREQUENCIES TO WHICH THE SET APPLIES. USE AS MANY PAGES AS NECESSARY.

SATELLITE TRANSMITTING BEAM DESIGNATION: T1

PAGE 3 OF 3

BR IDENTIFICATION NUMBER OF GROUP (LIST) OF FREQUENCIES TO BE MODIFIED / SUPPRESSED / REPLACED:

ADD / MOD / SUP / REP of the group:

CHARACTERISTICS COMMON TO THE FOLLOWING GROUP (LIST) OF ASSIGNED FREQUENCIES

C4a. CLASS OF STATION	TB	TI	TI	TB
C4b. NATURE OF SERVICE	FS	OT	FS	OT

C6. POLARIZATION: TYPE = CL; if linear, provide angle in degrees:

C3a. ASSIGNED FREQUENCY BAND (kHz): 1000

1000 for Kospas and 800 for SAR

C5b. RECEIVING SYSTEM NOISE TEMPERATURE kelvins: xx

EMISSIONS RECEIVED BY THE ASSIGNED FREQUENCIES LISTED BELOW

C7a. DESIGNATION OF EMISSION	C8e. C/N Objective (total - clear sky) dB
1M00G9D	

Or 800KG9D for SAR

MORE EMISSIONS ON NEXT PAGE

GROUP (LIST) OF ASSIGNED FREQUENCIES HAVING THE ABOVE COMMON CHARACTERISTICS

C2a. ASSIGNED FREQUENCY k/M/G Hz	C2a. ASSIGNED FREQUENCY k/M/G Hz
1544.5 M	

MORE ON NEXT PAGE

Form ApS4/III - 3b

-END OF ANNEX I-
-END OF DOCUMENT-

page left blank

Cospas-Sarsat Secretariat
Inmarsat, 99 City Road, London EC1Y 1AX, United Kingdom
Telephone: +44 20-7728 1391 Facsimile +44 20-7728 1170
Internet e-mail: *cospas_sarsat@imso.org*
Web Site address: *http://www.cospas-sarsat.org*